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A Conversation between Charles Spearman, Godfrey Thomson, and Edward L. Thorndike: The International Examinations Inquiry meetings 1931-1938

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Abstract

Even within "an appreciation of the fundamentally social nature of scientific activity" (Danziger, 1990, p. 3), it is unusual to read what key scientists actually said to each other, directly or in audience. Here we describe, structure, illustrate, and interpret the verbatim statements made by, and a detailed conversation that took place between, Charles Spearman, Godfrey Thomson, and Edward Thorndike within the Carnegie-funded International Examinations Inquiry meetings in 1931, 1935, and 1938. Unusually, there were transcriptions of all comments at these meetings, even of the smallest verbal utterance. The transcriptions offer a novel look at these researchers' theoretical and practical approaches to intelligence testing and its place in education. Aspects of Thomson's and Spearman's personalities are in evidence too, from this unique source. One particular conversation among the three leads to an important new insight about intelligence and intelligence testing. These conversations provide new and complementary information on a trio of leading intelligence researchers whose individual contributions and interactions with each other were seminal in the scientific study of human cognitive abilities.

The history of research in psychology, and in education, is a social and scientific history. Researchers are involved in a field of inquiry which, although it might take place in physically isolated laboratories or in private, professional spaces, is a connected field. Research takes place within "a pattern of social relations" (Danziger, 1990, p. 5) in which scientific norms are embedded, prominence and hierarchy are contained, frameworks of inquiry are recognized, and collaboration and argument flow. Danziger (1990) argues that the social relations of research extend beyond the place of production, and into a community which has to accept the validity of its work and into a professional environment of consumption and use by professionals and policy makers. Communication about field problematics, replication of findings and, particularly, on individual contribution and esteem, are an ever-present part of the production of the field. Much of this social element or social pattern of production is hard or impossible to reconstruct. It is rare to have a record of what scientists in a field actually said to each other. The International Examination Inquiry (IEI) meeting transcripts provide an exception (Monroe, 1931, 1936, 1939). They reveal what three important researchers in the field of human intelligence differences—Spearman, Thomson and Thorndike—say about their work and its usefulness within the deliberations of a group of educationists. Outside of the setting in which the conversations were recorded, we provide some background, first to the individuals themselves, and second to the personal and professional relations between these three men.

Spearman, Thomson and Thorndike

Charles E. Spearman's (1863-1949) major academic position was at University College London from 1907 until his retirement in 1931, where he was initially reader in experimental psychology and then consecutively occupied chairs of mind and logic, and then psychology. His many works on human intelligence differences included the famous

paper in which he discovered the general factor in human intelligence (Spearman, 1904), and his theoretical (Spearman, 1923) and empirical (Spearman, 1927) accounts of the nature and measurement of human intelligence. His early statistical contributions are regarded as "the earliest version of a 'factor analysis'" (Lovie & Lovie, 1996, p. 81). Godfrey H. Thomson's (1881-1955) major academic positions were at Armstrong College, Newcastle (a college of the University of Durham, England) from 1906 to 1925, and at the University of Edinburgh from 1925 until 1951, where he was the Bell Professor of Education and Director of the Moray House Teacher Training College. His research stretched from his early work on psychophysics (Thomson, 1912) and his original criticism of Spearman's general factor in intelligence (Thomson, 1916), via his major work on factor analysis of mental ability (Thomson, 1939), to his later work on intelligence and fertility (Thomson, 1950). Edward L. Thorndike's (1874-1949) principal academic appointment was at Teachers College Columbia, from 1899 until his retirement in 1940. He made early contributions to educational psychology (Thorndike, 1903) and to mental measurement (Thorndike, 1904), to intelligence testing and its applications to education (Thorndike, 1927), as well as research and writing on much broader topics (e.g. Thorndike, 1943). Thus, the three were all prominent and prolific in the field of human intelligence testing, and able on the statistical aspects.

Thomson was a personal friend of Thorndike's. Thorndike wrote to Thomson in Newcastle, England, out of the blue, inviting him to spend the academic year 1923-1924 at Teachers College at Columbia University, New York. Thomson accepted and Thorndike, "became one of my dearest friends, and for whose ability and greatheartedness I have infinite admiration" (Thomson, 1952). Both men, in their autobiographies, mention Charles Spearman in a negative sense. Thomson (1952) records that, "I learned a great deal from

Charles Spearman, but only by crossing swords with him, not as a pupil." Thorndike (1936) mentions that, "my tendency seems to have been to say 'No' to ideas. So I have been stimulated to study problems to which Romanes, Wesley Mills, Stanley Hall, Alexander Bain, Kraepelin, Spearman, and others seem to me to give wrong answers" (p. 268). Spearman's (1930) autobiography mentions both Thorndike and Thomson critically. Spearman states that, from 1904, his findings and conclusions were remote from, "the view of Thorndike, that the mind possesses an infinite number of abilities all mutually independent" (p. 325). Spearman writes that adherents of Thorndike's views tried to show that the hierarchy of correlations among mental test scores, on which the concept of the general factor in intelligence was founded, failed to occur. He then turned his fire on Thomson,

> "This amazing situation lasted until as late as 1914, when it was made even worse by further opposition to the Doctrine of Two Factors on exactly the opposite ground! Whereas the previous objection had been that the hierarchical arrangement did not actually occur, Thomson now announced that ordinarily it could not help occurring on purely statistical grounds by the very nature of correlational coefficients; it therefore could have no real significance." (Spearman, 1930, p. 325).

Spearman (1930) calls Thorndike, "the most 'hard-boiled' of our opponents," and also states that he is, "as tenacious as he is courteous" (p. 326). "[M]y literary life seems to have been one long fight," said Spearman (1930, p. 330), in which, "A conspicuous place here I assigned to Thorndike": "For him, the mind—like the brain as he conceived it—was composed of infinitely numerous minute elements connected together by associations, now presented under the name of 'bonds'." Symonds (1928), reviewing Spearman's 1927 book, agreed that his professional life was embattled: "the most virile attack on Spearman's position comes from Godfrey Thomson," (p. 24); and, "Spearman and Thorndike, although

they have been in controversy during practically the whole of their careers, hold positions which, after all, are separated by the merest thread of difference" (p.25).

By the time the three of them met at the IEI in the 1930s, Spearman had been "at odds with" (Lovie & Lovie, 1996, p. 82) Thorndike almost since his 1904 paper, and had a "long-running debate" (p. 82) with Thomson since 1916. Despite Spearman's acknowledging this long-standing difference with Thorndike, it did not prevent the latter involving Spearman prominently in the IEI and the parallel Unitary Traits Committee (Holzinger, 1936). Given these professional and personal relations it is interesting to inquire how they presented themselves and discussed ideas when they met together in close company with a distinguished international audience.

In addition to the information that the IEI transcripts provide into Spearman's and Thomson's and, to a lesser extent, Thorndike's views, they also provide insights into the relations between the work and ideas of these psychologists and the knowledge and expectations of the people (mainly British) who were engaged in the use and scoring of mental tests. What will be seen clearly in the discussions is that Thomson is, with respect to the psychology of intelligence, a hybrid of theoretician (Thomson, 1939) and practical deviser and user of tests (Sutherland, 1984, chapter 7). Spearman, by contrast, stays mostly in the role of the basic scientist of intelligence differences, and strives to make the audience aware of empirical findings in the field (Spearman, 1927). The transcripts are revealing with respect to how all three psychologists present their work in the practical setting of a group of educationalists discussing the problem of examinations.

The International Examinations Inquiry

In 1931, an international research project of which these three researchers were members, which gradually involved eight European countries (Scotland, Germany, Switzerland, France, England, Norway, Finland and Sweden) and the United States, began its work[1]. This project was the International Examinations Inquiry, a near-forgotten international and well-funded scientific network, which attracted key world figures in educational and intelligence research and undertook significant exchanges of data and experiment. It was funded and steered by the Carnegie Corporation in New York (Carnegie), with the crucial assistance of the International Institute at Teachers College, Columbia. There were three meetings: in 1931 at Eastbourne, in 1935 in Folkestone, both in England, and in 1938 at Dinard, near St Malo in France. The reports of the IEI's meetings (Monroe, 1931, 1936, 1939) include verbatim transcripts of presentations, discussions and even the most minor spoken comments. They afford an exploration of the relations and discussions of key thinkers in Europe working in education, and psychological assessment and testing. The IEI's focus was the new policy problem of examining for entry into the secondary school, which was shifting from its older, small elite status into a more meritocratic and expanded system.

The IEI funded a suite of European national research projects, which produced many significant publications on examinations and intelligence (including SCRE, 1933; Hartog & Rhodes, 1936; McLelland, 1942). The first of the three full meetings (Monroe, 1931) gathered the scholars together in a hotel in England and asked them to describe each nation's system of examinations and suggest empirical projects that Carnegie might support. The latter two core international IEI meetings had, as their key purpose, discussion and deliberation about the individual research reports, their methodological soundness and

[1] Members of the IEI referred to in this article, other than Spearman, Thomson and Thorndike, are listed in Appendix 1.

their understanding of the issue of examinations, and the linked questions of intelligence and the culture and technology of assessment.

The overall total of participants throughout the 1930s was probably near to one hundred people. The core of the project was a group of about twenty senior and nationally, sometimes internationally, known academics and research experts. The IEI comprised psychologists, progressive educators, comparative educationalists, statisticians and academic/policy actors. Its core members were approved by officers at Carnegie, often using Thorndike or Monroe, colleagues at Teachers College, as their guides. At each meeting, senior representatives of the Carnegie Corporation were present and spoke. Spearman and Thorndike attended all three of the meetings, and Thomson attended two. We examined closely the three volumes of the IEI transcripts, with a focus on Spearman's, Thomson's and Thorndike's contributions. A number of substantive themes emerged, and these are presented and discussed in the sections that follow.

Spearman the Theoretician of Intelligence

Spearman's contributions to the enquiry tend not to be in the form of reports, or direct concerns with the practical work of examining examinations. He comes across as being separate even from the other members of the English delegation. He comments when people make statements about abilities, especially when he does not agree with a statement. He gives long summaries of his own work and views on mental abilities. Thus, the IEI provides a useful new summary of the retired, late-period (he was 68 at the first meeting and 75 at the last meeting) Spearman's thinking on intelligence. Early on in the first meeting (Monroe, 1931, pp. 70-72) Spearman remarks on the psychological qualities needed for successful performance in life, remarking that this requires more than

intellectual qualities. He then talks about the G (his shorthand for the general factor derived from mental ability tests' correlations) having in addition the S (specific mental abilities, which are numerous). It is notable to hear the emphasis which Spearman places on the importance of non-G factors. Also notable is the insistence that G and intelligence are not the same thing, something which is often tacitly assumed in more recent writings on intelligence: "There is no such thing, but only a general factor *in* intelligence." (p. 72)

At times during the first IEI meeting, questions addressed to Spearman elicit from him an economical account of his views that are not available elsewhere. For example, the IEI's members became interested in what is being attempted by education. Wallas, from the English delegation, asks for some information about the place of basic psychological traits (Monroe, 1931, pp. 151-152). Spearman answers and, apparently unscripted, gives a long summary of G for the assembled listeners, of which this is an extract.

> "When asked what G is, one has to distinguish between the meanings of terms and the facts about things. G *means* a particular quantity derived from statistical operations. Under certain conditions the score of a person at a mental test can be divided into two factors, one of which is always the same in all tests, whereas the other varies from one test to another; the former is called the general factor or G, whilst the other is called the specific factor. This then is what the G term means, a score-factor and nothing more. But this meaning is sufficient to render the term well defined so that the underlying thing is susceptible to scientific investigation; we can proceed to find out facts about this score-factor, or G. We can ascertain the kind of mental operations in which it plays a dominant part as compared with the other or specific factor. And so the discovery has been made that G is dominant in such operations as reasoning, or learning Latin; whereas it plays a very small part indeed in such operation (sic) as

> distinguishing one tone from another… G tends to dominate according as the performance involves the perceiving of relations, or as it requires that relations seen in one situation should be transferred to another….
>
> "On weighing the evidence, many of us used to say that this G appears to measure some form of mental energy. But in the first place, such a suggestion is apt to invite needless controversy. This can be avoided by saying more cautiously that G behaves *as if* it measured an energy. In the second place, however, there seems to be good reason for changing the concept of energy to that of 'power' (which, of course, is energy or work divided by time). In this way, one can talk about mind power in much the same manner as about horse power….
>
> "…G is in the normal course of events determined innately; a person can no more be trained to have it in higher degree than he can be trained to be taller." (pp. 156-157)

The first two paragraphs are a remarkable summary of Spearman's empirical findings and ideas from major publications, including those of 1904, 1923 and 1927, with updates. They powerfully cover the nature and origins of intelligence. Spearman's comments about mental energy are new, and should be used to inform the many writers who use Spearman's 1927 book as the source of his ideas on this.

In response to a comment after this long exposition, Spearman repeats the same list of ideas, at length, paraphrased, but in oddly similar terms, almost like an audiotape being re-wound and played again. Though the idea of G is more than 25 years old by the time of this meeting (Spearman, 1904), it is surprising to hear that, even to some of these senior people in education, it comes across as a novelty. For example, in response to Spearman's expositions the session Chairman (Smith, from the Scottish delegation) responds that Spearman, "is now bringing the methods of science to bear upon these dark places of the

youthful mind, and is experimentally verifying, it seems to me, traits which have been dimly and vaguely apprehended by the massive experience of mankind, or glimpsed by the insight of poets" (Monroe, 1931, p.159).

At the second Inquiry meeting in 1935 (Monroe, 1936) Thomson is not present; Spearman and Thorndike are. Much more of this meeting's transcript is reports of the studies that the national groups have been doing. There is not much from Spearman at all in the 300 pages of this volume. Spearman, once again: tends to speak only in response to questions or to something with which he disagrees; gives, thereby, useful, economical summaries of his views; does not make a report directly on the topic of examinations or from any investigation carried out by the English delegation; and recounts the basics of intelligence theory and measurement. Moreover, we again see his tendency to repeat very similar spoken material, at some length, after just a short delay. For example, here is an extract from Spearman's first substantial statement, quite late in the meeting (Monroe, 1936, p. 257),

> "It was said this morning that education should fall into two phases, I understood. First should come, at an early period, the measurement of the *connaissance* of the nation, and then, at a later period, should come the measurement of aptitudes. I venture to suggest, particularly in view of what we have just heard, that that is exactly what is wrong. What we require is first to measure the aptitudes and then the information required; measure the aptitudes, ascertain what each member of the community is best fitted for, and then give him the instruction that is necessary in order to carry out those duties along those lines. That, of course, brings up the whole question of measuring aptitudes, to what extent that can be done. Well, I think it is quite impossible to do that unless the aptitudes are in comparatively small number. It

> is impossible to take an unlimited number of measurements, and that means again that the question seems to reduce itself to asking whether the great variety of the aptitudes that we see can to any large extent be reduced to functions of a limited number more or less independent of one another; and that brings us to a movement in which several people present here are mainly interested, the movement for ascertaining the possibility of factorizing, reducing all the infinite complexity of types and so forth into various combinations and permutations of a limited number of factors, each in itself unitary."

After less than a page, and with just one comment from Kandel, Spearman responds, after being asked to elaborate by Hartog, with a long answer that is staggeringly similar to the one given above (Monroe, 1936, pp. 258-261)[2]. As we noted from the 1931 meeting, Spearman appeared to have quite long set pieces in his mind, from which he deviated little. The "movement" referred to by Spearman is the Unitary Traits Committee (UTC: see Holzinger, 1936, for an account of this). The UTC was: urged by the Problems and Plans Committee of the American Council on Education; chaired by Thorndike; funded by the Carnegie Corporation; included such great names as Thorndike, Spearman, Kelley, Hull, Lashley, and Holzinger; and funded Holzinger and Spearman to carry our research in schools in Chicago in the 1930s. The driving idea was that a person could be described in terms of a relatively small number of uncorrelated traits. The UTC produced several reports.

At the third Inquiry meeting Spearman, Thomson and Thorndike are all present. It is rare in these meeting transcripts to have sections where any two or all three of them speak close in time to each other, but it does occur in this last meeting. Thomson and Spearman talk at the

[2] Hartog and Kandel represent mainstream comparative education scholarship which, focussing on identity and nation, is being attacked by Spearman.

end of the English presentation. At this third meeting Thomson has moved from being a Scottish to an English delegate, though his professional position is still at the University of Edinburgh, Scotland. Neither Spearman nor Thomson report findings; they provide discussion in response to the reports and to questions from the floor. Thomson talks for three whole pages of the transcript (Monroe, 1939, pp. 155-158); then Spearman talks for three whole pages (pp. 158-160). Thomson is very practical and focussed on the results to hand, and on particular examinations. Thomson's practically-oriented contributions are displayed and discussed more below. Spearman, by contrast, once again goes back to basics and talks about theory and general results to do with intelligence, "In treating the present problem [measuring future capacity] I should like to go back to first principles" (p.158). The first principles involve Spearman's standing back from the problem of using examinations for selection and formulating it again in basic trait terms. One of his concerns was that correlations between individual tests and measured outcomes were often modest.

> "In this quandary, I would suggest that considerable progress may be achieved by the modern procedure called factorization. On applying this to the ordinary tests of I.Q.—in particular the Binet scale—the correlations between these and other measures of ability have been found traceable to two constituents. The one is the well known general factor or G, and has been reported to measure the 'noegenetic' power of perceiving self-evident truths. The other is the factor designated as V and would seem to measure the association of symbols with the meanings which they symbolize….
>
> Finally, all this analysis into G and V may well be a prelude to further no less cardinal advances. W. Alexander, for instance, has added to these what he designates as F and regards as a measure of practical ability (by no means to be confused with what is commonly measured by the so-called performance tests). Mental tests present

> at least three very important differences of constitutions. One type, characterizing most of the tests that are employed for determining IQ, contains both G and V. Another contains only G, and a third contains G together with F. According to Alexander [probably Alexander, 1935], this triform analysis should dominate psychology. Quite a large number of children, he says, excel in the F factor and should therefore be led into vocations which call upon G plus F, rather than G plus V. Accordingly their examination, and even their education, should chiefly regard not G plus V but G plus F performances."

A remarkable aspect of this contribution is Spearman's development of thinking beyond his two-factor theory. Instead of just general and specific factors, here Spearman is accepting of other group factors of mental ability discovered after *g* has been taken into account.

We explained elsewhere that research on human intelligence was divided into: a fast-growing movement after 1905, following Binet, interested in measurement and the prediction of outcomes, especially educational outcomes; and a far smaller enterprise, after 1904, including Spearman, more interested in explaining intelligence differences (Bartholomew, 2004, chapter 2; Deary, 2000, chapter 3). The IEI transcripts reveal Spearman's continued adherence to the findings of basic science on intelligence, and his distance from practical measurement. From Thomson, we hear the reverse.

Thomson the Practical Tester of Intelligence

Spearman and Thomson debated the psychometric structure of mental abilities for a quarter of a century (e.g. Thomson, 1916, 1939-1940). It is easy to over-estimate their disagreements: Spearman writes combatively, and Thomson's writings are often technical. For example, Spearman's (1916) rebuttal to Thomson's (1916) first *g*-related paper begins,

"At the present time, I have little leisure, or indeed inclination, for controversy. But the foregoing clever and interesting paper seems likely to produce grave misunderstanding unless some brief comments are attached" (p. 282). However, in summing up at a 1939 British Psychological Society symposium on the factorial analysis of ability, Thomson (1939-1940, p. 106) weighs up the intelligence theories of Thurstone and Spearman, as follows,

> "I myself lean at the moment more towards Spearman's *g* and his later group factors than I do to Thurstone's…"

In the same paper Thomson remarks that, "Surely the real defence of *g* is simply that it has proved useful" (p. 106). This characterises Thomson's contributions to the IEI meetings; his finding tests of intelligence useful. By contrast with Spearman's always going back to basic psychometric findings and theory, Thomson's contributions are predominantly practical.

Thomson's first contribution at the first IEI meeting is to provide information for the English delegation (he is a Scottish delegate). Here is a short extract.

> "…I fancy there is one point in which the English delegation have understated the progress made in modern methods of examining and testing in England. I suspect that some present, in particular Professor Spearman, could also confirm that there is a good deal more use made of these modern methods of examining in England than might be thought by the others from what has been said by the English delegation. I happen to know from the Scottish side, also, that this is the case. In the University of Edinburgh it is the chief work of one of the classes of my research students under my guidance to make tests of intelligence and in some few cases of attainments in English and in arithmetic for a number of English educational authorities, about a

> dozen every year, for that very important examination at eleven plus, when the bifurcation or the trifurcation of the children into the secondary, the central, and other lines of advance in education begins. My department in Edinburgh University is also very widely consulted on the statistical side of those examinations… It is true, as Mr. Hepburn said, that we in Scotland have a body of teachers who, in proportion to the total number of teachers, are more numerous than elsewhere, who have been trained in the making and in the use of tests." (Monroe, 1931, pp. 120-121).

Thus Thomson informs the English delegation that, from his base in Scotland, he is doing much work for them of which they seem partly unaware. Thomson's mental-test producing laboratory (almost a factory) was a phenomenon. The Moray House tests eventually ran to dozens of separate tests (Thomson, 1940a; Sutherland, 1984). The verbal reasoning tests were used for secondary school selection in many English regions. These group-administered tests correlated highly with the individually-administered Binet tests (SCRE, 1933). Thomson is known for countering Spearman's *g* theory of intelligence, but his production of mental tests and the analysis of their results is an under-unappreciated (including by even the English at the IEI audience) mammoth effort (Sutherland, 1984). The network of individuals involved in producing the tests and the financial arrangements surrounding the tests are also notable; they will be mentioned only briefly here, and dealt with in more detail elsewhere.

Thomson puts forward some suggestions for study from the Scottish delegation. They are very practical. The first, "has just occurred to us of the Scottish delegation during today. It is felt that an enquiry should be made into the speed with which examiners are forced to mark papers" (Monroe, 1931, p. 148). Thomson talks about the various levels of education at which he has examined. He goes on, and perhaps indicates he is in two minds about the

massive testing exercise in which he has such a leading role, “as a person who is often consulted by education authorities, mainly in English counties and towns, on the problems arising in their [eleven-plus] examination, which for good or evil has become so important in England…” Just as may be seen below with Spearman’s comments during this transcribing of unscripted speech at the IEI, aspects of Thomson’s character emerge. Developing his practical suggestion, Thomson remarks (p. 148-149),

> “If you asked them how much time they actually spend on reading the papers, there may be some of them—wicked men—who postpone the examination papers until the last two or three days.”

In addition to this hint of conscientiousness, there are indications of thrift too. He makes retrospective and prospective proposals to look at how well exams predict what people will do at university. He also suggests looking forward from some of the eleven-plus examinations to see how well people did at school and university. This applies to England (he is not a member of that delegation yet). What is notable about this last suggestion is Thomson’s proposal to use existing data (Monroe, 1931, p. 150),

> “There is a mass of material in England which is in different hands. Many English counties, as I have said, have employed different ways of selecting at age eleven plus for entrance upon various forms of secondary education. In several places which have obtained my assistance in making these investigations they have, at my suggestion, begun to keep record cards and other forms of record of the children as they passed through the secondary schools, and in some cases those children are now in universities. There has been one small but very illuminating research by Mr. J. F. Duff on the Northumberland children whom we first tested in 1920, which was published in the *British Journal of Psychology*. I know of several men in different counties who are not perhaps psychologists and who are not statisticians, and who

> have very little time to spare, but who are very interested. They are mostly Clerks of Education Committees, Directors of Education or their assistants or subordinates, who have in their possession records, and who have no little expert practical knowledge of how to handle these records, and who, if they could be brought together and have financial assistance under someone's guidance, could carry out a joint follow-up enquiry."

This economical, network-type operation is similar to what happened in the Scottish Mental Survey of 1932 (SCRE, 1933), funded by the IEI (i.e., the Carnegie Corporation) after this first meeting. Thomson envisages making use of an existing network in order to accomplish a comprehensive-scale operation. Indeed, much of what we hear here from Thomson, and what appears from the Scottish delegation in the proceeding IEI volumes may already be seen in Thomson's early work, before he arrived in Edinburgh. While still at Armstrong College, Thomson developed mental tests (Northumberland Mental Tests) and had already tested over 13,500 children in an area-wide, comprehensive study (Duff & Thomson, 1923-1924). Thus, above, we see his thinking out loud about how he sees his research network, comprising those interested, embedded, non-academic professionals who have access to the subjects and sight of their data. Thomson and Spearman both had substantial military responsibilities in their careers, but it is Thomson who carries military-style organisation into his research. Leadership, for Thomson, is based upon the ability to realize a complex vision, harnessing the abilities and interests of others, and not just in the clarity with which one continually represent and repeats one's views.

Thomson is absent from the second meeting of the Inquiry and appears for the English delegation at the third meeting (Monroe, 1939). He starts to give a talk on page 155 of the transcript (September 17, 1938), "I have had a sabbatical year and have not really been an

active member of the English Committee." During this time he wrote his major work, *The Factorial Analysis of Human Ability* (Thomson, 1939). When he gets into his stride—he has made almost no contribution to the meeting prior to this point—he returns to practical issues and his involvement with mental testing in England at the age of eleven plus.

> "I have spent a good deal of my life in connection with that examination, partly for the reason that its early precursor had such an influence on my own life. I was just finishing my own early elementary school education and I was going to work at the age of thirteen when rather unexpectedly I got the chance, through such an examination, to go on to a secondary school. I do not know whether I am happier than I would have been if I had been a pattern maker, which was what I was going to become. I think I am. At any rate, it seems to me very important that the examination should be conducted so as to be as just as possible to the children, and two things which have been mentioned at this meeting seem to me of great importance. I have had a great deal to do with that examination in England—more than I would like in some ways. Of the 500,000 children who are examined at that age in England every year, I have something to do, directly or indirectly, with about 160,000 of them, or my staff has—a pretty big responsibility to bear. We do all that we possibly can, and perhaps I may be permitted to add that we turn all the money we get, either by way of fees or of royalties, into the work of trying to make this examination better." (Monroe, 1939, p. 155-156).

Thus, again, by comparison with Spearman, Thomson is very practical and focussed on the results to hand, and on particular exams. Despite his long in-print debate with Spearman, he does not respond to him, and, with one exception (discussed below) never speaks about intelligence theory. Thomson's sense of duty and worries about fairness to children come out clearly. Owing a debt to such examinations, which made his professional career

possible, is a recurring statement from him (e.g. Thomson, 1952). His mention of having had more to do with the examination than he would like is ambiguous, perhaps; it might hint at his having done this work out of duty, or his being in two minds about being so prominent in using these tests for such an important purpose. He washes his hands of the money, investing it in trying to make the tests better. Today, decades after the Moray House Tests were used in large numbers, there is still an income to the University of Edinburgh from the money invested from sales of the tests. He ends his talk by admitting that he should like to have done something other than these tests by way of making educational decisions for the youngsters involved. The difference between the uses of mental tests in the UK and the USA becomes clear when Wood from the USA delegation mentions that things are more problematic in the USA because of the lack of national exams. Thomson's reply is informative in a number of ways. He recounts that only 12% or so of children in the UK at that time get secondary school education. He talks of obtaining data about school grades in some English areas, and again the research clearly makes use of a network: "but I find that actually in each district it is mostly the Teachers Union which asks for inquiries, which helps to finance them, and which does most of the spadework." (Monroe, 1939, p. 161). Thomson reports that the correlations they observe from English areas between the eleven-plus IQ testing and success in secondary schools are like the ones that McClelland obtained in Dundee, Scotland. McClelland's study of the predictive validity of IQ and other tests for success in secondary education was one of the two principal studies undertaken by the Scottish delegation between the second and third Inquiry meetings. It was published later as a monograph (McClelland, 1942). In this type of study the focus tends to be on the predictor; that is, its reliability and its predictive validity. At the time, the pressing problem was that secondary school places were very limited and so-called wastage of such valuable places, in terms of pupils selected for secondary

schooling who did not then complete it, were to be avoided as efficiently as possible. Thomson sees, though, that these practical matters may be construed another way (Monroe, 1939, p. 162),

> "Of course, the criterion itself is unreliable. One might turn the tables and say the way to improve the secondary school examination is to see how you can alter it so that its results agree with those which Professor Thomson has given at the entry of the secondary school! Of course; why not? The two things are both of them fallible measures."

The section which follows again shows how Thomson wears his dutiful heart on his sleeve; in his scientific practice it seems that explicit righteousness is an important thing to Thomson (Monroe, 1939, pp. 162-163),

> "The change which I have seen since the War [World War I] has been very great. The alteration in the English examination system at eleven plus, the alteration in the attitude of the teachers to it and the alteration in the attitude of the education committees to it, among whom I go and meet at their invitation, are very great indeed; so that one can have the happiness of feeling that there has been a great improvement and that teachers do understand more what it is about. Of course, they only listen if they feel you are sincere about it. If one can only make them believe that one is trying to be helpful for everybody, then it works. If they think you are trying to make money or prestige it does not. That is one reason why many of the things we could publish we do not publish, partly because they do not give permission, partly because we do not ask them because they do not like to be asked, and partly because we do not want to run the risk of being suspected of making anything out of it, even kudos. There are

> many things I am pessimistic about, but that is not one. I think that every day and in every way we are getting better and better—slowly!"

This apparently light-hearted reference to the motto of Émile Coué, the psychotherapist whose ideas were popular in the UK and USA at that time, may be taken more or less at face value as a Thomson credo. Thomson tries to mediate in the gap between policy and research. He tries to produce the best science of intelligence and the best-validated tests and, working with local authorities, he tries to work openly and fairly with his results and their system management concerns. He mediates between two types of uncertainty—in science and selection. In doing this, he sees his task as being pedagogic, allowing the audience to recognize probabilities and to make their judgements. Speaking to very senior international colleagues in the IEI setting, Thomson would not attempt humbug; in fact, he comes across as a genuine, practical psychometric saint.

Spearman the Contrarian

In all three IEI meetings Spearman stands out as the person most likely to be blunt and to pick an argument. This novel information is consistent with others' views of Spearman. For example, Symonds (1928, p.22), in a review of Spearman's (1927) *Abilities of Man*, remarked, "The book irritates the reader by its style, quite apart form its argument. The author evidently goes through life with a chip on his shoulder." Even within his own English team, Spearman argues at length with other statisticians about inference and interpretation and he delays the publication of their book on Examination marking. Thomson's (1947) fair and full obituary of Spearman mentions, with respect to Spearman's tetrad method of extracting a general factor, "It can be and has been developed into more general techniques, and it is a pity that the controversy about the 'existence of *g*' led Spearman to hold aloof from and look askance at these" (p. 382).

The first disagreement occurs at the IEI's first meeting, indeed in its opening sessions, when the French notion of *culture générale* is raised by Hartog from the English delegation. Bouglé from the French delegation enlarges, "There is a saying of Montaigne which we use to excess, 'A head well formed is better than a head well filled.'" (Monroe, 1931, p. 46). He enlarges on the idea of *culture générale*; it is not specialisation, vocational preparation, or encyclopaedism. It is learning to learn, "not a mosaic of information, but a gymnastic of the mind" (p. 46). In the dozens of pages of the transcript thereafter there is a long discussion about what culture is; discussing the idea that education is more than vocational training. The delegates talk about the spirit and the personality of the person. Eventually Spearman speaks, pricking the French bubble for raising the idea that culture can be cultivated in general.

> "For instance, the great aim of education called culture was said to be a cultivation of the gymnastic of the spirit. But here the question arises as to whether, in point of fact, any such general cultivation is possible. Much experimental work has been done, largely on the initiative of Professor Thorndike, which indicates that the possibility of cultivating any general ability, or anything else of a general character, admits of grave doubt." (p. 70)

He is also unhappy with the use of personality as the basis of culture, "In fact, to explain culture in this way seems a case of *obscurum per obscurius*."

In the third meeting of the IEI Spearman, after talking about the need to understand better what different delegates were trying to achieve, states that,

> "Even at this meeting I engaged in an argument with a gentleman which broke down on the fact that he wanted not only to tell me his own views but to tell me mine. There is another gentleman present with whom I have had many arguments, and I find that

he states many things in seeming opposition to me whereas really they are statements with which I perfectly agree and have long ago said myself." (Monroe, 1939, p. 158)

Spearman's admission of an outright argument is the only recorded one in all three meetings; the transcripts reveal entirely courteous and deliberative exchanges. Even though he is essentially recording agreement with the second gentleman, it is put in a combative way.

Spearman's combative style—employed toward his better understanding some data, it should be emphasised—comes across best in a long exchange with the Scottish delegation in the third IEI meeting. The exchange is between the practical Scots and the more theory-oriented Spearman. The immediately-preceding presentation was by Kennedy-Fraser, of data that appeared later in a monograph (MacMeeken, 1939). Drever was the convener of the Scottish Committee. Thomson is mysteriously silent during these exchanges, though he is a member of this Scottish Inquiry Committee, listed at the start of MacMeeken's monograph as an investigator. The Scottish report, to which Spearman is the first to respond, concerns the testing of a random sample of 874 Scottish children on the Binet Test and on so-called performance tests of intelligence. The children are all those born on 1st February, 1st May, 1st August, and 1st November 1926. A short extract of the exchange proceeds as follows (Monroe, 1939, the exchange occurs between pp. 197-200),

Spearman: "From the report I gather that there was one set of tests of 'intelligence,' and then there was a second set of 'performance' tests. I should like to ask what meanings those two terms have, what relations to one another, and what relations to other mental activities. The two, I take it, must have some psychological meaning in order to be psychologically useful."

Drever: “Actually the Binet-Simon tests we used and the performance tests used are given in the report.”

Spearman: “What do they mean respectively? What is the relation between them?”

Drever: “We do not know. This is part of the evidence which we have, on which we can base an opinion.”

Spearman: “The answer to the question seems to be urgently needed.”

Drever: “I am afraid I do not understand the point that Professor Spearman is raising. We all know what the Binet-Simon series of tests is. We know that the standard tests are used for a certain purpose throughout all English-speaking countries. We employed the Binet-Simon tests. We also applied a group of typical performance tests and the evidence that we have here is the data resulting from such tests.”

Spearman: “You get a test to measure something. What does it measure? For instance, you take ‘the repetition of five digits’ to measure ‘intelligence.’ Are these two activities one and the same? If not, what is the relation between them? And what attitude do you adopt towards abilities that do not come under either the one sort of heading or the other?”

Drever: “Of course, that is entirely irrelevant to our inquiry.”

Spearman: “I should have thought it was the essence.”

Rusk: “That is for psychologists like Professor Spearman to work out. We are merely practical investigators. We are following the procedure that is employed in practically all the countries in the world.”

Spearman: “It seems to me that we are doing a thing without knowing what we are doing.”

Rusk: “Yes. We do that in a great many things.”

The discussion proceeds unrelentingly for a long time in this manner, with the hapless Scots pinned to the wall by Spearman whose conclusion about the large Scottish investigation is that, "it seems to me to be working in the dark". Thomson never speaks. At one point Spearman offers them a way out, stating that Alexander's (1935) multi-factor model might offer an analytic framework. Other Scots step in to help: Kennedy-Fraser says they are merely practical researchers; Henderson asks what *g* is; and Kennedy-Fraser states that it and other factors seem to have been of little use. The latter two comments are all the more bitter, since it is 34 years since Spearman published his first, famous paper on *g*, and he has also spent such a high proportion of his speaking time at the IEI meetings reiterating its meaning and application. The correlations between the performance tests and the Binet tests were already computed and available (MacMeeken, 1939), and it is surprising that the Scots did not merely report them. The sorts of multivariate analyses that Spearman was asking for from the dataset were published by Thomson (1940b, 1941-1942), who found that there were speed factors in addition to the general factor in this battery of tests. This is just the sort of answer that Spearman was seeking: what existed, in addition to general ability, among the mental tests? Since Thomson published twice along these lines from these data, at dates soon after the meeting, it is odd that he makes no recorded response after so many strongly-worded attacks on the data from Spearman, while his senior Scots colleagues were ravaged. It is possible that Thomson was inspired by Spearman's questions and theoretical thinking to conduct the analyses. This is nearer to Thorndike's position too. Such a detailed and revealing exchange would never otherwise have been captured had the IEI not chosen to make an unexpurgated record of the meetings' sessions.

One could interpret this conversation, and Spearman's other general interventions, as a problem with Spearman's being involved, perhaps inappropriately, in a practical and

pressing programme on improving education chances and elite education. It appears that he repeatedly misunderstands the problem to be faced—it is not really about intelligence, but about taking any stable element as a standard by which tests and judgments can then be made. Rusk and Drever are, therefore, quite right in their practical setting. Thomson has separated himself into two working parts, one to deal with the problem of science and one to deal with the problem of policy.

A Psychometrics Masterclass

Spread across the three large volumes of the IEI transcripts, there is little that might be called novel in terms of its development of ideas about intelligence, although there is much about their use and value. An exception is a conversation among Thorndike, Spearman and Thomson quite close to the end of the final meeting. Thorndike was talking about academic tests, and mentions (Monroe, 1939, p. 244),

> "Both objectively scorable tasks and tasks of the traditional sort can be improved by attaining a higher degree of what students of mental measurement call 'purity'. A task is pure when it measures one ability unmixed with any other. A task is impure in proportion as it measures a compound or complex of that ability with others."

He gives examples. He uses two 10-item multiple choice vocabulary tests to show that one is purer than the other. One contains words than can be worked out from the classics and sciences, the other not. The key idea here, which Thomson soon catches on to, is that a content-knowledge test placed before a student might be more or less amenable to thinking things out on the spot; that is, more or less susceptible too, or loaded with, the application of the person's *g*. Thorndike also mentions that writing definitions of the words—compared with, for example, merely having to put a cross in a multiple choice format—adds some

other ability again to the task. He says sometimes we need the mix to be assessed but (pp. 246-247),

> "…for many purposes it is better to analyze the mixtures we use into their purer constituents…. The scores of a thousand pupils in the task of writing definitions of a hundred English words are like the ratings a mineralogist might give to a thousand samples of lead ore from a general inspection, if these samples contained lead plus some gold and some silver. But if lead is what is wanted, the amount of gold and silver may be irrelevant. And ordinarily the mineralogist should report the three percentages, of lead, gold, and silver, for each specimen rather than a general rating of value."

Thorndike continues with an interesting discussion about examinations in various subjects and the problems and strategies of having them pure, or contaminated with the application of intelligence. Spearman replies to Thorndike at some length, emphasising that tests often require the exercise of intelligence and a verbal factor, and that obtaining purity in tests will be very difficult. Thorndike replies that, "I am concerned with getting those abilities as far as possible out of measurements which purport to be measurements of something else" (Monroe, 1939, p.256). It is clear at this point that Spearman has only half grasped what Thorndike means. Spearman is thinking in terms of mixtures of uncorrelated factors, such as were at that time being sought by him in the Unitary Traits Committee, whereas Thorndike is referring to combinations of capabilities more subtle and entwined. Thomson does grasp it (Monroe, 1939, pp. 256-257),

> "I should like to think aloud for a moment about these pure factors of Professor Thorndike's. They are very interesting, because they are not the same thing as the factors that we have been commonly using in 'factorial analysis'. They would not be

> uncorrelated; they would be correlated. When we speak of a G factor—and let us assume for the purpose of this talk that we can measure the G factor with complete accuracy—when we have a G factor and a V factor and an F factor they are imponderable factors which are not correlated with each other. Therefore if you know a man's G you have no knowledge at all of his V; you cannot predict in the slightest what kind of verbal factor he will have if you know his G; they are uncorrelated. That is not the case with these other factors, which I think possibly are more useful, which Professor Thorndike has envisaged. He would make a test in German (say) such that intelligence is not helpful *while the candidate is doing the test*, but only sheer knowledge of German. But of course intelligence would have helped the candidate in acquiring the German, *before the test*. This is a new sort of factor. The factors that are commonly got by analysis by any of the factorial methods are things which are uncorrelated, whereas these new factors are something which you could, of course, make some prediction of, knowing the man's intelligence, because if a man is intelligent and has been exposed to it he is highly likely to know German, but the test itself would not require intelligence."

This is a novel insight on the part of Thomson. It is an early statement of what came to be known as fluid and crystallised intelligence. His idea that there can be a test which assesses the past application of one's intelligence but, crucially, for which the application of intelligence would not help at the time the test is being performed is a conceptualisation of crystallised intelligence (Horn & Cattell, 1966). In addition, the idea that intelligence has contributed to individual differences in the learning of German encapsulates the investment idea of intelligence: that fluid intelligence is the machine that leaves behind in the mind a crystallised product (Cattell, 1987). Thorndike agrees with this, and also tries to explain to the audience that manipulating (including eliminating) the power of expression—such as

making crosses versus writing continuous prose as an answer to a test—is easier than eliminating an hypothetical verbal factor from a test. Spearman then asks (p.257) “May I ask if I understand Professor Thorndike rightly to say that if you eliminate the element of G, or whatever you like, then the other, by definition, must be independent of it?” This shows again that Spearman is stuck, thinking in a different way from Thorndike, who clarifies (p.257),

> “No; I did not use the word ‘factor’ anywhere. Everything I said would have been just as true if the axes of the ellipses had been at right angles or twisted or spiral. All that I say is that if we get rid empirically of power of expression by having the person make crosses instead of writing sentences, we get a thing which is not entirely pure but which is purer, and for certain purposes better. If we get rid of intelligence in the case of knowledge of history or algebra, it is not the same one thing that we get rid of in the case of a foreign language when we get rid of a person’s ability to use the context intelligently. That part of intelligence is what we get rid of by using disconnected sentences instead of continuous discourse. I do not pretend that we are getting rid of pure factors, or that the purity that is got finally, say the purity of knowledge of French, is of an ability which would be uncorrelated with any of these other abilities that we have tried to get rid of. The ability left might have very substantial correlations with them.”

More uncomprehending exchanges take place between Spearman and Thorndike, with regard to what is being eliminated when Thorndike tries to eliminate the current application of intelligence from the performance of a school test. Then, Thomson again tries to explain his view (p.258),

> "In Professor Thorndike's point of view he is eliminating the use of intelligence *while that test is being performed*; but, of course, intelligence has been used in the past in obtaining that knowledge. Intelligence must not be used in the test, but, of course, intelligence will have had its play in arriving at that knowledge of German with which you do the test, and therefore the way you do the test will be correlated with your intelligence, only what you measure at the time is your knowledge of German at that time, not your ability to guess what it should be. It is not the conception of factors that we have had before; it is a new conception, and much of the apparent opposition is due to that—to not appreciating the novelty of the suggestion."

Spearman makes a vague reply, giving no indication that he has understood this novel idea. Hamley tries to clarify (p. 258): "It seems to me that Professor Thorndike's illustration of the gold and lead is pertinent here, because they are different things, and that is what you are trying to get from the various tests, because they can be resolved still into elements, each of them." Thomson replies in an uncharacteristically blunt manner (p.258), "That is a very bad illustration of my point, I fear." But the brilliant reply from Thorndike precisely catches Thomson's 'investment hypothesis' idea, and tweaks the metaphor adroitly and alchemically (p.258), "Except that some of the lead may have turned into gold."

Thorndike's point is exactly right, as is Thomson's rejecting Hamley's over-stretched application of the metallic metaphor. The formulation of Thomson's is akin to the idea, again, of the fluid-crystallised distinction, and the investment hypothesis of intelligence, something that cannot be handled by independent factors. It is Spearman who does not seem to catch on here, and Thorndike's apparently quick retort at the end shows that he has picked up what Thomson had thought out on his feet. This is a masterclass in ability theory

and measurement—resulting in a novel concept, only realised decades later (Horn & Cattell, 1966)—and none of the others at the IEI makes a contribution during this exchange. It is much later that this Thorndike-Thomson idea became widely appreciated and led to the conception of estimating 'premorbid' ability in for example, people with dementia, by divining their preserved knowledge in the face of their deteriorated fluid *g* (e.g. McGurn et al., 2004).

Conclusions

The IEI transcriptions offer new insights into two out of the three major and connected psychologists, all of them experts in intelligence theory, measurement, and analysis, and all acting within a policy focused network, trying to use their knowledge and expertise to solve a crucial problem in the reconstruction and expansion of their education systems. Thorndike quietly fulfils his role as a facilitator, using lightly the enormous authority of his own expertise and his role in influencing the construction of the IEI. Thomson is the one who works across the role of expert and policy actor. There is the issue of 'usefulness' and practicality without doubt in Thomson. But another element is caution—Thomson works within a frame of probabilities which allows him to reduce uncertainty. He comes across as almost apologetic about his huge involvement in intelligence testing for school selection. He almost never asserts a theoretical viewpoint. Spearman constantly shifts onto certainty—this is a real point of difference between them as well. Whereas Thomson is practical, Spearman is theoretical and focussed on basic science, emphatically reminding the audience of the ideas and results of both, respectively. In the only 'live' record of their public personae of which we are aware, Thomson is polite almost to diffidence, whereas Spearman is blunt, occasionally verging on the argumentative and rude. Their involvement in the Inquiry is partly focused on testing but if they were to be tested on their involvement,

Thomson tries to bridge the theory-practice gap, leaving Spearman reiterating his theories and related findings, and obstinate defences, to an audience that he seems to view, as we might, as surprisingly uninformed about intelligence. As a scientific conversation, it leaves Thomson and Thorndike engaging with their knowledgeable but inexpert audience, in a way that Spearman does not.

The IEI transcripts contain a three-way conversation among Spearman, Thomson and Thorndike that constitutes a ‘psychometric masterclass’ which is unlikely to have been revealed by other means. It is a direct result of discussion between them—principally Thorndike and Thomson; Spearman appears to miss the point. Close reading of the conversation reveals a sketch of the much-later-formulated investment theory of fluis and crystallised intelligence, which is still dominant today, especially in the study of cognitive ageing (Craik & Bialystok, 2006).

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Appendix 1

Other members of the International Examinations Inquiry mentioned in text.

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